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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/816,694	03/23/2001	Shabbir Ahmed	051583:0249	5216
23524	7590	04/21/2004	EXAMINER	
FOLEY & LARDNER 150 EAST GILMAN STREET P.O. BOX 1497 MADISON, WI 53701-1497			RIDLEY, BASIA ANNA	
			ART UNIT	PAPER NUMBER
			1764	

DATE MAILED: 04/21/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

**Office Action Summary**

Application No.

09/816,694

Applicant(s)

AHMED ET AL.

Examiner

Basia Ridley

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☐ Responsive to communication(s) filed on \_\_\_\_.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-22 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-22 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 23 March 2001 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- |  |   |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)                        | 4) <input type="checkbox"/> Interview Summary (PTO-413)                     |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)               | Paper No(s)/Mail Date. ____.  |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| Paper No(s)/Mail Date <u>080301, 120202, 072103</u> .  | 6) <input type="checkbox"/> Other: ____.                                    |

## DETAILED ACTION

### *Oath/Declaration*

1. The oath or declaration is defective. A new oath or declaration in compliance with 37 CFR 1.67(a) identifying this application by application number and filing date is required. See MPEP §§ 602.01 and 602.02.

The oath or declaration filed on 9 July 2001 is defective because:

The specification to which the oath or declaration is directed has not been adequately identified. See MPEP § 601.01(a). Specifically, the filing date and the Application Number are not provided.

### *Information Disclosure Statement*

2. The information disclosure statements filed on 3 August 2001 and 2 December 2002 fail to comply with 37 CFR 1.98(a)(2), which requires a legible copy of each U.S. and foreign patent; each publication or that portion which caused it to be listed; and all other information or that portion which caused it to be listed. It has been placed in the application file, but the following documents referred to therein have not been considered as to the merits:

- Choudhary et al. "Simultaneous oxidative conversion and CO<sub>2</sub> or steam reforming of methane to syngas over Co<sub>0</sub>-Ni<sub>0</sub>-Mg<sub>0</sub> catalyst", as only an abstract of said publication was included;
- Wegeng et al. "Compact fuel processors for fuel cell powered automobiles based on microchannel technology", as provided copy of the document is not legible.

3. The information disclosure statements filed on 3 August 2001 and 2 December 2002 fail to comply with the provisions of 37 CFR 1.98(b) for the reasons set forth below. They have been placed in the application file, but the following documents referred to therein have not been considered as to the merits:

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- Krumpelt et al. "Catalytic Autothermal Reforming for Fuel Cell Systems" because it is not identified by date and place of publication;
- Ahmed et al. "Catalytic Partial Oxidation Reforming of Hydrocarbon Fuels", because it is identified by two different dates ("November 16-19, 2000" and "1998").

***Specification***

4. The disclosure is objected to because of the following informalities:

- on page 9, lines 23-25, "efficiency is defined as the lower heating value of the product hydrogen, as a percentage of the lower heating value of the fuel feed" is not clear;
- on page 10, lines 18-20, "Table 1 shows (...) water to fuel molar ratios ( $2n - 2x - p$ ) [the water/fuel molar ratios in Table 1 are greater than  $2n - 2x - p$ ]" is not clear - are the water to fuel molar ratios in Table 1 ( $2n - 2x - p$ ) or are they greater than  $2n - 2x - p$ ?
- the specification should be amended to include current status of all referenced nonprovisional parent applications, e.g. application disclosed on page 12, lines 2-6;
- the legend of Table 2 (page 14) does not specify if  $x_0$  values were calculated for liquid water or for water vapor;
- on page 18, lines 4-5, "(0.8 wt. % platinum on gadolinium doped ceria ( $\text{Pt/Ce}_{0.8}\text{Gd}_{0.2}\text{O}_{1.95}$ ))" is missing a parenthesis.

Appropriate correction is required. Applicant is reminded that no new matter shall be added.

5. The specification is objected to as failing to provide proper antecedent basis for the claimed subject matter. See 37 CFR 1.75(d)(1) and MPEP § 608.01(o). Specifically, claim 19 recites "the oxide-ion conducting portion of the catalyst is selected from a ceramic oxide from the group crystallizing in the fluorite structure or  $\text{LaGaO}_3$  or mixtures thereof". While the

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specification on page 16 lines 19-25 and page 17, lines 1-3 discloses that various catalysts can be used in the method of the present invention, for example catalysts disclosed in USP 5,929,286, neither the instant specification nor the USP 5,929,286 disclose what specific ceramic oxides are included in the group crystallizing in the fluorite structure.

Correction is required. Applicant is reminded that no new matter shall be added.

***Claim Objections***

6. Claim 9 is objected to because of the following informalities:

- in claim 9 recitation "the mixture of gases comprising N<sub>2</sub> and molecular oxygen is air" should be replaced by --the molecular oxygen is supplied to the fuel processor is air--.

Appropriate correction is required. Applicant is reminded that no new matter shall be added.

***Claim Rejections - 35 USC § 112***

7. The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

8. Claim 19 is rejected under 35 U.S.C. 112, first paragraph, because the specification, while being enabling for using a catalyst wherein the oxide-ion conducting portion of the catalyst is LaGaO<sub>3</sub>, does not reasonably provide enablement for using the catalyst wherein the oxide-ion conducting portion of the catalyst is selected from a ceramic oxide from the group crystallizing in the fluorite structure. The specification does not enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to use the invention commensurate in scope with these claims.

Claim(s) 19 recite the limitations "the oxide-ion conducting portion of the catalyst is

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selected from a ceramic oxide from the group crystallizing in the fluorite structure or  $\text{LaGaO}_3$  or mixtures thereof". While it is clear that the group of ceramic oxides which read on the recited catalyst includes at least  $\text{LaGaO}_3$ , it is not clear what other "ceramic oxides" are included in the "the group crystallizing in the fluorite structure". While the specification on page 16 lines 19-25 and page 17, lines 1-3 discloses that various catalysts can be used in the method of the present invention, for example catalysts disclosed in USP 5,929,286, neither the instant specification nor the USP 5,929,286 disclose what specific ceramic oxides are included in the group crystallizing in the fluorite structure.

***Claim Rejections - 35 USC § 102***

9. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

10. Claim(s) 1-20 are rejected under 35 U.S.C. 102(b) as being anticipated by Krumpelt et al. (USP 5,929,286).

Regarding claim 1, Krumpelt et al. discloses a method for generating  $\text{H}_2$  rich gas from a fuel comprising:

- supplying a mixture of molecular oxygen, fuel, and water to a fuel processor (C3/L11-20);
- converting the mixture of molecular oxygen, fuel and water in the fuel processor to the  $\text{H}_2$  rich gas (C3/L42-C4/L2); wherein
- the fuel has the formula  $\text{C}_n\text{H}_m\text{O}_p$ , where n has a value ranging from 1 to 20 and is the average number of carbon atoms per molecule of the fuel, m has a value ranging from 2 to 42 and is the average number of hydrogen atoms per molecule of the fuel, p has a value ranging from 0 to 12

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and is the average number of oxygen atoms per molecule of the fuel (C3/L11-12); and wherein

- the molar ratio of molecular oxygen supplied to the fuel processor per mol of fuel is represented by the symbol  $x$  and has a value ranging from about  $0.5x_0$  to about  $1.5x_0$ , wherein  $x_0$  is equal to  $0.312n - 0.5p + 0.5(\Delta H_{f,\text{fuel}}/\Delta H_{f,\text{water}})$ , where  $n$  and  $p$  have the values described above  $\Delta H_{f,\text{fuel}}$  is the heat of formation of the fuel and  $\Delta H_{f,\text{water}}$  is the heat of formation of the water (C3/L16-19).

Regarding claims 2-11 and 14-20, Krumpelt et al. discloses all of the claim limitations as set forth above. Additionally the reference discloses the method wherein:

- converting the mixture of molecular oxygen, fuel and water in the fuel processor to the  $H_2$  rich gas further comprises contacting the mixture of molecular oxygen, fuel and water with a catalyst in the fuel processor to produce the  $H_2$  rich gas (C3/L11-C4/L2);
- the molar ratio of molecular oxygen supplied to the fuel processor per mole of fuel is  $x$  and has a value ranging from about  $x_0$  to about  $1.5x_0$  (C3/L16-19 and C3/L34-35);
- the molar ratio of molecular oxygen supplied to the fuel processor per mole of fuel is  $x$  and the molar ratio of water supplied to the fuel processor per mole of fuel is a value ranging from about  $0.8(2n - 2x - p)$  to about  $2.0(2n - 2x - p)$ , (C3/L16-19 and C3/L34-35);
- the molar ratio of water supplied to the fuel processor per mole of fuel is a value ranging from about  $0.9(2n - 2x - p)$  to about  $1.5(2n - 2x - p)$ , (C3/L16-19 and C3/L34-35);
- the molar ratio of water supplied to the fuel processor per mole of fuel is a value ranging from about  $0.95(2n - 2x - p)$  to about  $1.2(2n - 2x - p)$ , (C3/L16-19 and C3/L34-35);
- the molar ratio of water supplied to the fuel processor per mole of fuel is a value ranging from about  $1.0(2n - 2x - p)$  to about  $1.1(2n - 2x - p)$ , (C3/L16-19 and C3/L34-35);
- the molecular oxygen is supplied to the fuel processor in a mixture of gases comprising  $N_2$  and

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molecular oxygen (C1/L22-30 and C2/L52-67);

- the mixture of gases comprising  $N_2$  and molecular oxygen is air (C1/L22-30 and C2/L52-67);
- the fuel is selected from the group consisting of methane, methanol, ethane, ethylene, ethanol, propane, propene, i-propanol, n-propanol, butane, butene, butanol, pentane, pentene, hexane, cyclohexane, cyclopentane, benzene, toluene, xylene, natural gas, liquefied petroleum gas, iso-octane, gasoline, kerosene, and diesel (C1/L44-57, C2/L3-5, C3/L11-12, C3/L28-35);
- the fuel is selected from the group consisting of methane, natural gas, propane, methanol, ethanol, LPG, gasoline, kerosene, and diesel (C1/L44-57, C2/L3-5, C3/L11-12, C3/L28-35);
- the molar ratio of molecular oxygen supplied to the fuel processor per mole of fuel is  $x$  and has a value ranging from about  $0.8x_0$  to about  $1.4x_0$  (C3/L16-19 and C3/L34-35);
- the molar ratio of molecular oxygen supplied to the fuel processor per mole of fuel is  $x$  and has a value ranging from about  $0.9x_0$  to about  $1.3x_0$  (C3/L16-19 and C3/L34-35);
- the molar ratio of molecular oxygen supplied to the fuel processor per mole of fuel is  $x$  and has a value ranging from about  $0.95x_0$  to about  $1.2x_0$  (C3/L16-19 and C3/L34-35);
- the molar ratio of molecular oxygen supplied to the fuel processor per mole of fuel is  $x$  and the molar ratio of water supplied to the fuel processor per mole of fuel is a value ranging from about  $1.0(2n - 2x - p)$  to about  $1.1(2n - 2x - p)$ , (C3/L16-19 and C3/L34-35);
- the catalyst comprises a two part catalyst comprising a transition metal and an oxide-ion conducting portion, and the mixture of molecular oxygen, fuel, and water is contacted with the catalyst at temperature of  $400^\circ\text{C}$  or greater (C1/L58-C2/L2, C2/L43-C3/L44);
- the transition metal is selected from the group consisting of platinum, palladium, ruthenium, rhodium, iridium, iron, cobalt, nickel, copper, silver, gold, and mixtures thereof, and the oxide-ion conducting portion of the catalyst is  $\text{LaGaO}_3$  (C1/L58-C2/L2 and C2/L43-65);



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- the catalyst is selected from the group of autothermally reforming catalysts that operate at a temperature ranging from about 100°C to about 700°C (C3/L11-C4/L2).

Regarding claims 12-13, Krumpelt et al. discloses all of the claim limitations as set forth above. Additionally the reference discloses the method wherein the fuel process or is maintained at a temperature of from about 100°C to about 900°C and from about 400°C to about 700°C.

While the reference does not explicitly disclose the fuel processor comprising a reforming portion, presence of said portion is inherent in a fuel processor where hydrocarbon fuel reacts with water.

***Claim Rejections - 35 USC § 103***

11. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

12. Claim 21 is rejected under 35 U.S.C. 103(a) as being unpatentable over Krumpelt et al. (USP 5,929,286), as applied to claim 2 above, and further in view of Collins et al. (USP 5,458,857).

Regarding claim 21, Krumpelt et al. discloses all of the claim limitations as set forth above. Additionally the reference discloses the hydrogen production method, as set forth above, wherein hydrogen rich gas is produced for use in fuel cells (C1/L15-21). Further, the reference discloses that the hydrogen rich gas produced by the disclosed method comprises carbon monoxide (C3/L42-C4/L2). But the reference does not explicitly disclose any steps to further purify produced hydrogen rich gas.

Collins et al. teaches a method for production of hydrogen for use in fuel cells (C1/L5-10) by reforming hydrocarbon fuels. Carbon monoxide is removed from produced hydrogen rich gas

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by contacting the hydrogen rich gas with a second catalyst effective at converting carbon monoxide and water into carbon dioxide and  $H_2$  to produce a second gas further enriched in hydrogen and with a reduced level of carbon monoxide (abstract). Further the reference teaches that removing carbon monoxide is beneficial in hydrogen production for fuel cells not only because it recovers additional hydrogen but also because it protects fuel cells from CO poisoning (C2/L18-29).

It would have been obvious to one having ordinary skill in the art at the time of the invention to contact the hydrogen rich gas produced by the method of Krumpelt et al. with a second catalyst effective for converting carbon monoxide and water into carbon dioxide and  $H_2$ , as taught by Collins et al., for the purpose of improving process efficiency by recovering additional hydrogen and for the purpose of improving fuel cell operation by removing carbon monoxide which is poisonous to fuel cell catalyst.

13. Claim 22 is rejected under 35 U.S.C. 103(a) as being unpatentable over Krumpelt et al. (USP 5,929,286) in view of Collins et al. (USP 5,458,857), as applied to claim 21 above, and further in view of Ohata et al. (USP 4,708,946).

Regarding claim 22, Krumpelt et al. in view of Collins et al. disclose all of the claim limitations as set forth above. Additionally Collins et al. discloses that the conversion of carbon monoxide and water into carbon dioxide and  $H_2$  is performed over a suitable second catalyst (C4/L43-49). While the reference teaches some exemplary suitable catalysts (e.g. C5/L41-44) the reference does not explicitly disclose any other suitable catalysts.

Ohata et al. teaches a catalyst comprising a transition metal on cerium oxide or on ceria doped with a rare earth metal or an alkaline earth element, wherein the transition metal is selected from the group consisting of platinum, palladium, nickel, iridium, rhodium, cobalt, copper, gold,

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ruthenium, iron, silver and combinations thereof, the rare earth element is selected from the group consisting of gadolinium, samarium, yttrium, lanthanum, praseodymium and combinations thereof, and the alkaline earth element is selected from the group consisting of magnesium, calcium, strontium, barium and combinations thereof (C3/L38-50 and C4/L26-32). The reference teaches that said catalyst has "an outstanding ability to (...) promote water gas shift reaction" (C4/L26-32).

It would have been obvious to one having ordinary skill in the art at the time of the invention to use the catalyst of Ohata et al. comprising a transition metal on cerium oxide or on ceria doped with a rare earth metal or an alkaline earth element as a second catalyst effective for converting carbon monoxide and water into carbon dioxide and H<sub>2</sub> in the hydrogen rich gas produced by the process of Krumpelt et al. in view of Collins et al. since doing so would amount to nothing more than a use of a known catalyst for its intended use in a known environment to accomplish entirely expected result. An ordinary artisan would be motivated to replace catalyst of Collins et al. with a catalyst offering "outstanding" performance for the purpose of improving operation and efficiency of the process.

14. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(f) or (g) prior art under 35 U.S.C. 103(a).

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*Conclusion*

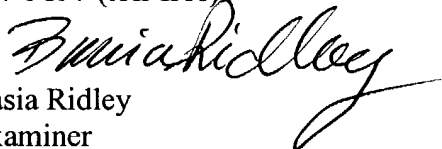
15. In view of the foregoing, none of the claims are allowed.

16. Any inquiry concerning this communication or earlier communications from the examiner should be directed to examiner Basia Ridley, whose telephone number is (571) 272-1453.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Glenn Caldarola, can be reached on (571) 272-1444.

The fax phone number for the organization where this application or proceeding is assigned is (703) 872-9306.

Technical Center 1700 General Information Telephone No. is (571) 272-1700. Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Questions on access to the Private PAIR system should be directed to the Electronic Business Center (EBC) at (866) 217-9197 (toll-free).

  
Basia Ridley  
Examiner  
Art Unit 1764

BR

April 15, 2004